

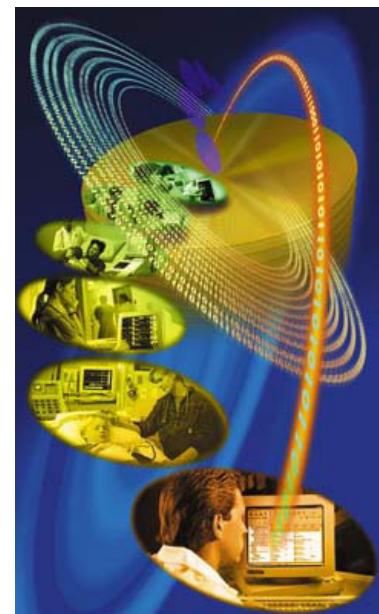


Ambulatory Blood Pressure Monitors

90207/90217
Operations Manual

070-0137-03 Rev. J

more time to care



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CAUTION:

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US Federal law restricts the devices documented herein to sale by, or on the order of, a physician.

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Overview

The Spacelabs Medical Models 90207 and 90217 Ambulatory Blood Pressure (ABP) monitors are small, lightweight, battery-powered units designed to take blood pressure and heart rate measurements for 24 or 48 hours, or for longer periods of time.

These measurements are recorded in the monitors and may be transferred to an ABP Analysis System (FT1000A/FT2000A or equivalent), the PC Interface, the Base Station, or a Report Generator for data analysis, report printing, and archiving.

Each monitor and a base station can operate in a direct connect mode (when both units are in the same location) or in a remote connection mode (using modems).

ABP Monitor

The monitors have the following features:

- Four-digit LCD display
- Battery powered
- Serial communications port
- Power ON/OFF switch
- Reading START/STOP button
- Blood pressure cuff

The monitors are carried in pouches that are strapped and/or belted to the side of the patient. Blood pressure and heart rate measurements are taken using a blood pressure cuff attached to the patient's arm. This information is recorded in the monitors and can be transferred over a modem link or by direct connection between the monitors and one of the ABP analysis systems.

The monitors can be programmed to either activate or deactivate the following features:

- Display the cuff pressure at each bleed step.
- Display the systole, diastole, and heart rate at the end of each measurement.
- Bleed to 40 mmHg rather than stopping at the diastolic value.
- Beep before and after each reading.

Front Panel

The 90207 and 90217 front panels include the LCD display, cuff hose connector, and a START/STOP switch.

Rear Panel

The rear panels of both monitors contain program input and data output communication ports. On the 90207, the power ON/OFF switch is also located on the rear panel. On the 90217, the ON/OFF switch is located on the top panel.

Replacing the Batteries

“AA” batteries provide the main power source for the monitors. The 90207 uses four batteries, and the 90217 uses three. These batteries should be replaced or recharged before the start of each patient monitoring. Use either alkaline or NiCad batteries.

In the 90207, a lithium battery (P/N 146-0008-xx) is used to back up the monitor memory and should be replaced periodically. The 90217 backup battery should not require replacement.

Main Battery Replacement

Note:

If the main “AA” batteries must be replaced during patient monitoring, this replacement must be accomplished within one minute to ensure successful resumption of the test (90207 only).

- 1 Power the monitor OFF, and remove the door over the battery compartment.
- 2 Replace the AA alkaline or NiCad batteries, being careful to observe polarities.

Caution

- The monitor will not operate if the alkaline, nickel cadmium, or lithium batteries are incorrectly installed. If the monitor is going to be stored for an extended period of time, remove the batteries to prevent the possibility of leakage or discharge.
- Spacelabs Medical is not responsible for product damage incurred as a result of AA battery leakage. In the event your unit has been damaged by a leaking battery, contact the battery manufacturer for any recoverable repair or replacement costs. Spacelabs Medical will assist you in determining those costs.

- 3 Gently replace the battery cover and secure the latch.
- 4 Power the monitor ON. Check that the LCD display is ON. If there is no display, power the monitor OFF and review the problem-solving checklist in *Troubleshooting* on page 3-1.

Lithium Battery Replacement (90207 only)

The lithium battery is located in the battery compartment under a pry-off cover to the right of the AA batteries.

- 1 Power the monitor OFF, and remove the door over the battery compartment.
- 2 Remove the pry-off cover, and note the polarity of the battery and socket indicators.
- 3 Remove the old lithium battery by carefully prying it out (curved forceps are recommended).
- 4 Install the new lithium battery and replace the pry-off cover. The underside of this cover is divided into two unequal-sized compartments. Install the cover with the smaller compartment oriented over the lithium battery.
- 5 Gently replace the battery compartment cover and secure the latch.

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Note:

Once the lithium battery has been completely discharged, it is considered non-hazardous and can be safely discarded.

Initializing the Monitor

The ABP monitors must be initialized prior to the start of patient monitoring. Initialization specifies the monitoring period, patient information, time format, measurement interval, monitor tone ON/OFF during selected periods, event code display, and whether or not to display pressure values. To initialize the monitor, connect it to one of the following analysis systems.

Connecting Directly to a Local Report Generator

For a direct connection to the 90207 or 90217 monitor, place the monitor into the chute on the Report Generator (Model 90239A or equivalent) as displayed below.

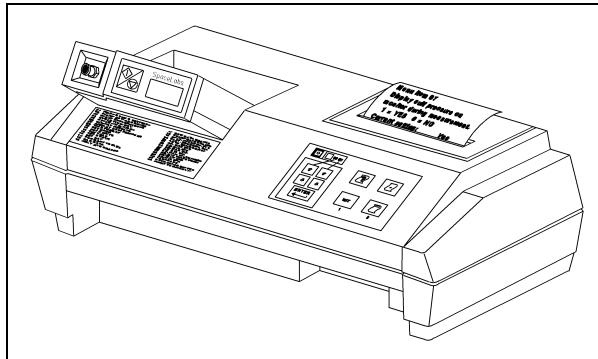


Figure 1-1: Report Generator

Connecting Directly to the PC Interface

For a direct connection to a PC-compatible computer via a Model 90121, 90219-02, or 90219-03:

- Connect the ABP interface cable to the serial port on the 90219 or 90121 system and to the monitor. Refer to the 90121 *ABP Report Management System Operations Manual* (P/N 070-0529-xx) for more information on the report management system.

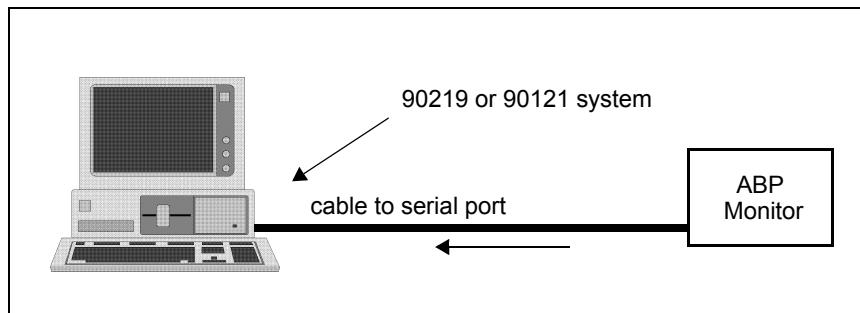


Figure 1-2: PC interface direct connect configuration

Connecting to the Base Station via Modem

For a modem connection to a remote IBM XT/AT/PS2 (or equivalent) base station, refer to *Figure 1-3*.

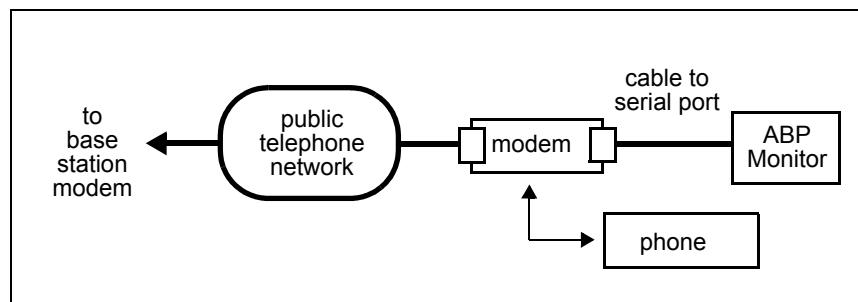


Figure 1-3: Modem connection configuration

Note:

The actual initialization procedure is discussed in the 90219 ABP PC Interface/Base Station Operations Manual (P/N 070-0238-XX).

Modem Speed and Compatibility Issues

The 90207 and 90217 units operate Hayes-compatible modems only. You can identify your model type by plugging the communications cable into your 90207/90217 unit and looking at the numbers on the display. The acceptable modem types and maximum speeds of 90207/90217 units are summarized below:

Table 1: 90207/90217 acceptable modem speeds

Model Type	Max Speed	Modems Accepted	Display
older 90207	1200	1200 only	9999
newer 90207	1200	any Hayes	1999/9999
older 90217	up to 9600	up to 9600	2999/9999
newer 90217	9600	any Hayes	0999/9999

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Connection Procedure

- 1 If you are using an older 90207 with a 1200 modem, set the switches on the modem as follows:

Switch #	Setting at monitor site
1	down
2	up
3	down
4	down
5	down
6	up
7	up
8	down
9	up
10	up

- 2 Connect the serial port cable (P/N 012-0096-00) between the monitor and the modem.

Note:

If call waiting or call forwarding are options on a telephone used to transfer data, ensure that both are deactivated. Otherwise modem communications may be interrupted. In addition, telephone systems such as CBX or PBX can cause interference with the modem, or the modem can cause interference with the switching system.

To initialize the monitor for remote connection:

- 1 Contact the base station by telephone (for remote operation only).
- 2 Ask the base station operator to initialize the monitor. Give the following information to the operator:
 - Patient's name
 - Patient ID number
 - Whether monitor display is to be active or not
 - Time of day (12- or 24-hour format)
 - Whether to display measurement (systolic/diastolic and heart rate)
 - Multiple or single cycle times. If using a single cycle for the 24-hour monitoring period, indicate the cycle interval and whether the tone is on or off. For multiple cycle times, specify each cycle interval and whether the tone is on or off for each cycle.
 - Any other information the base station operator may request
- 3 The base station operator enters the patient information in the computer.
- 4 Prepare the monitor to receive the patient data from the base station.
 - Power ON the modem.
 - When instructed by the base station operator, power ON the ABP monitor.

Note:

The modem link must be established within 10 to 20 seconds for the 90207, and within 45 seconds for the 90217. If this does not occur, power the monitor OFF and then ON again to retry.

- 5 When the transfer of information is complete, the ABP monitor will beep. Voice communication is restored after the monitor beeps.
 - Power OFF the monitor and disconnect the monitor from the modem.
 - If direct connection between the monitor and the base station is used, power OFF the monitor and disconnect it from the ABP data interface unit.

To transfer readings from the monitor to the base station:

- 1 Contact the base station by telephone (for remote operation only).
- 2 Ask the base station operator to read the monitor. Give the following information to the operator:
 - Patient's name
 - Patient ID number
 - Any other information the base station operator may request
- 3 The base station operator enters the patient information in the computer. (If the monitor is in a remote location, the operator turns the base station modem ON.)
- 4 Prepare the monitor to transfer data to the base station.
 - Power ON the modem.
 - When instructed by the base station operator, power ON the ABP monitor (for remote operation only).

Note:

The modem link must be established within 10 to 15 seconds for the 90207, and within 45 seconds for the 90217. If this does not occur, power OFF the monitor and return to step 1.

- 5 When the transfer of information is complete, the ABP monitor will beep. Voice communication is restored after the monitor beeps.

Power OFF the monitor. Disconnect the monitor from the modem.

Modem Indicator Lights

Modem indicators at the local modem are lit, flashing, or unlit depending on the stage of operation. When the monitor is turned on, the RD (Receive Data) and SD (Send Data) lights will flash for several seconds. The OH (On Hook) indicator becomes lit when the monitor starts communicating with the remote modem. When the modems connect, the CD (Carrier Detect) is lit. The SD and RD lights flash as data is being transferred.

After the transmission is complete and the monitor is turned off, the HS, TR, and MR indicators will always remain lit at the local modem.

Setup Test

Note:

Verify that the cable connections are secure.

Power ON the ABP monitor. It will display "9999." While the monitor is being read or initialized, the digits will change to indicate that communication is taking place between the monitor and the analysis system. When communication is complete, the digits will no longer change.

Office Check Mode

The monitor automatically enters an office check mode for the first five measurements immediately following initialization. This allows you to verify the performance of the monitor on an individual patient without the need for re-initialization to reset the display features.

While in the office check mode, the monitor operates as follows:

- Displays the cuff pressure on each bleed step
- Displays systole, diastole, and heart rate at the end of the measurement
- Bleeds one step below the diastolic value as determined by the monitor

Terminating Office Check Mode

For the 90207 (versions earlier than 2.14), press the START/STOP key twice to cancel each of the remaining readings. The office check mode is terminated when the sum of the canceled and successful measurements equals five.

For the 90217 and 90207 (versions 2.14 and later), press the START/STOP key twice to cancel a single blood pressure reading. The office check mode is terminated when a blood pressure reading is canceled.

Any event that prevents a successful blood pressure measurement (other than a manual cancel) is not counted as one of the five office check mode readings.

Reinstating Office Check Mode

The office check mode can be reinstated in the 90217 and the 90207 (versions 2.14 and later).

To reinstate the office check mode without initialization of the monitor:

- 1 Power ON the monitor.
- 2 When the version displays on the LCD, press and hold the START/STOP key.
- 3 Release the START/STOP key when EC03 displays on the LCD.

An EC13 will be logged to indicate the time at which the office check mode was reinstated. The office check mode will be enabled for five additional successful measurements.

Preparing the Patient and Precautions for Use

- *Blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultation method, within the limits prescribed by the American National Standard, Electronic, or automated sphygmomanometers.*
 - *The fifth Korotkoff sound was used to determine overall efficiency.*
- *As in manual auscultatory methods, accurate readings might not always be achieved under some conditions. Patient movement, the position of the cuff relative to the level of the heart, extreme heart rates and blood pressures, various arrhythmias, and the subject's physiological condition and other factors can hinder an accurate reading. Vibration, such as that in a moving automobile, is an environmental problem that can affect readings.*
- *When some of the above factors prevent an accurate reading, an event code is provided to indicate the reason for the missed blood pressure reading. When only a single blood pressure parameter (systole, diastole, or mean arterial pressure) is obscured and the other two parameters are measured, the obscured parameter can be replaced with a computed value.*
- *If such a value is computed in the 90217, it appears on the report in angle brackets, e.g., < value >. On the monitor display, dashes are displayed instead of the estimated value. The ratio used in the formula is determined by the previous successful measurements of the pressure, rather than a fixed ratio.*
- *Consult a physician for interpretation of pressure measurements.*

After the monitor has been initialized, prepare the patient for monitoring as follows:

- 1 Power ON the monitor (wait for the monitor to perform self-tests). When the LCD displays the current time, the monitor is ready for operation.
- 2 Strap the monitor to the patient's hip opposite the side on which the cuff is worn. Secure the monitor using the patient's own belt or the ABP pouch strapped over the opposite shoulder. When using the shoulder strap, use the belt supplied with the monitor or the patient's belt to provide additional security.
- 3 Proper cuff selection and application is essential to ensure the accuracy of blood pressure measurements. To select the proper cuff, first measure the circumference of the limb at the point where the cuff is to be applied. Match the limb measurement to the range of appropriate circumferences (in centimeters) specified on each cuff (refer to *Table 2*).

Table 2: Cuff sizes, Circumference Ranges and Part Numbers

Description	Limb Circumference	Part Number Quick-Disconnect	Part Number Luer-Lock
Pediatric Cuff	12 to 20 cm	015-0118-01Q	015-0118-01
Small Adult Cuff	17 to 26 cm	015-0067-01Q	015-0067-01
Adult Cuff	24 to 32 cm	015-0068-02Q	015-0068-02
Large Adult Cuff	32 to 42 cm	016-0077-01Q	016-0077-01
Extra-large Adult Cuff	38 to 50 cm	016-0109-01Q	016-0109-01

Table 3: Optional Accessories

Accessories	Part Number
Cuff Support Harness	015-0070-xx
Service Manual	070-0502-xx
Quick Disconnect Coupling	712-0794-00
Male Quick Disconnect to Luer Adapter	712-0773-00

4 Position the cuff so that the center of the inflatable bladder is directly over the brachial artery. The center of the bladder location is marked on the outside of the cuff. Once the proper position is determined, the cuff must be tightened to ensure that it is equally snug at the top and bottom edges and that it is not kinked. This is especially important on larger arms. Insert a finger between the cuff and the limb to ensure it is not too tight. It may be necessary to wrap the cuff with its tail at an angle to achieve uniform tightness. If the cuff is not equally snug at the top and bottom edges, the number of readings available will be limited and the monitor may indicate that the cuff is improperly applied.

Caution

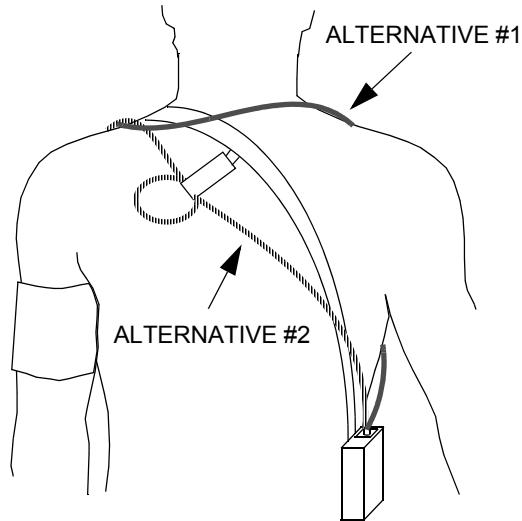
- **Avoid compression or restriction of pressure in the NIBP patient connector tubes.** Check that operation of the equipment does not result in prolonged impairment of circulation.
- **Do not apply cuff to areas of breached or injured skin.**
- **This product contains natural latex rubber components to which some people may be allergic. These components include the bladder and the first four inches of tubing extending from the cuff.**

Note:

- Use only Spacelabs Medical cuffs with this monitor. Using other manufacturer's cuffs may result in inaccurate readings, even if the manufacturer's recommended size is observed.
- If the cuff is too small, pressure readings may be falsely high; a cuff that is too large produces a falsely low reading. The bladder can be positioned in the cuff for either the left or right arm.

5 Once the cuff is applied, the arm should be relaxed at the patient's side. To avoid reading errors due to hydrostatic pressure differences, the level of the cuff on the arm should be near the level of the heart.

6 Lead the hose up the arm with the cuff and place it across the back of the patient. Drape the hose so it does not cause the patient discomfort and is not pinched shut by too tight a radius. The following figure shows the most common positions for the cuff hose.



- 7 Connect the hose to the monitor.
- 8 To verify proper monitor operation, take one or more blood pressure readings. Push the START/STOP key to begin a measurement. Spacelabs Medical recommends taking three readings in the office so that the patient becomes comfortable with operation of the monitor and the measurement process.
- 9 Show the patient how to enter information in the patient diary. Make sure the patient knows what to do if the cuff becomes very uncomfortable during a measurement, if it slips out of place, or if event codes are displayed on the monitor screen (refer to *Patient Instructions* on page 1-11). In addition, ensure the patient knows how to care for the monitor.
- 10 When you are satisfied that the monitor is operating properly, the remaining measurements in the check mode can be canceled. Refer to *Office Check Mode* on page 1-7.

Using Cuff Support

Note:

Keeping the blood pressure cuff in place is very important both for patient comfort and for accuracy of the readings. This becomes particularly challenging when the arm has considerable taper, as is often the case with obese patients.

- 1 Once the cuff is successfully applied to the patient, put the large loop of the support around the opposite arm. Adjust the length so that the junction of the straps fits well back on the shoulder towards the neck.
- 2 Fasten the rear short strap to the rear of the armpit. Be careful to clip to the material only and not to the bladder.
- 3 Fasten the front strap to the top layer of the cuff material at the location where the hose exits the cuff. Adjust the length of these straps to apply a minor amount of tension to hold the cuff in position.

Correlating with Manual Readings

The monitor bleeds pressure in discrete steps (not continuously), using the oscillometric method of blood pressure determination. If manual pressure readings are taken simultaneously with the monitor readings, interpolation is required to accurately correlate monitor systolic and diastolic pressure values with the manual auscultatory pressures.

- For systole, record the first pressure at which a Korotkoff sound is heard. Actual systolic pressure is somewhere between the pressure when the sound is heard and the previous (higher) pressure where no sound was heard. The interval of uncertainty can be reduced by half by adding one half of the bleed step size (4 mmHg) to the manual systolic pressure.
- For diastole, record the cuff pressure at which the last Korotkoff sound was heard. Actual diastolic pressure is somewhere between that pressure and the next lower pressure. Thus, you must **subtract** one half of the bleed step size (4 mmHg) from the manual diastolic pressure.

Patient Instructions

If the cuff becomes uncomfortable during a reading, make certain the patient knows how to terminate the readings by pressing the STOP key on the front of the monitor.

If the cuff slips out of place, make certain the patient understands correct repositioning of the cuff for successful readings. If the cuff is not properly positioned, event codes may appear on the monitor.

Note:

The patient should make every effort to keep the monitor dry. However, there is no hazard if the monitor does get wet. If this occurs, turn the monitor off and return it to Spacelabs Medical for service.

Data Transfer and Reports

After monitoring is complete, connect the monitor to either a PC Direct or Base Station interface to transmit patient data and generate blood pressure reports. Refer to 90121 *ABP Report Management*, 90219-02/03 *ABP PC Interface/Base Station* (P/N 070-0238-xx), or 90239 *ABP Report Generator* (P/N 070-0399-xx) Operations Manuals for more details.

Note:

Any pulse rate obtained from the ABP cuff should be used only as a guideline for the heart rate.

Cleaning

Visually inspect the monitor, air hose, and pressure cuff for dirt, debris, frayed or worn areas, etc., prior to patient use.

Cleaning the Monitor

Use a soft, damp cloth and mild detergent mixed with water to wipe the exterior of the monitor. Clean the air hose with isopropyl alcohol.

Cleaning the Cuff and Carrying Pouch

Small soiled or stained areas may be cleaned by gentle scrubbing with a sponge or cloth soaked in a mild soap and water solution.

The cuff wrap (with the air bladder removed) and the pouch are machine washable on "delicate" cycle only. Do not wash in large commercial-type washers or with bed linens or gowns.

Ensure that the carrying pouch is dry before re-use.

Removing/Installing the Bladder

To remove the bladder, follow the steps listed below.

- 1 Using fingers only, fold or roll up the bladder inside the cuff. Do not use pencils, pens, or other hard objects, because these may damage the bladder.
- 2 Remove the bladder through the hose exit opening.

Once the bladder is removed, mate together the hook-and-loop surfaces of the velcro attachment before washing.

Re-install the bladder into the cuff wrap in reverse order. Make certain that all folds in the bladder are removed and that the long end of the bladder fits into the long end of the cuff (refer to *Figure 1-4*).

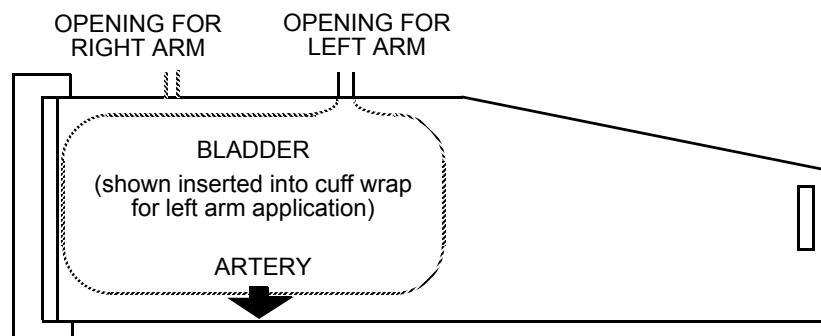


Figure 1-4: Bladder configuration

Note:

The cuff hose can exit from either opening in the cuff, depending on whether you plan a right arm or left arm application.

Event Codes

The monitor displays an event code whenever an event prevents the unit from successfully completing a blood pressure measurement. The two numerical digits of the event code indicate the reason the measurement was aborted. The table below lists event codes that are displayed on the monitor, as well as event codes that appear on the Event Code Report.

Monitor	Report	Condition
EC00		
	EC10	Excess movement artifact. Frequent EC10 messages may indicate an air leak.
	EC20	A) A very large number of movement artifacts B) Heart rate arrhythmia
	EC30	A) Movement artifact at mean arterial pressure B) Heart rate arrhythmia
	EC40	A) Movement artifact at asystole B) Heart rate arrhythmia
	EC50	A) Movement artifact at diastole B) Heart rate arrhythmia
	EC60	A) Movement artifact B) Heart rate arrhythmia
	EC70	Systole was found to be above the highest cuff pressure. However, this result appears to be an error caused by motion artifact. Therefore, the cuff will not be inflated to a higher pressure on the next measurement attempt.
	EC80	A) Movement artifact B) Heart rate arrhythmia
	EC90	A) Movement artifact B) Heart rate arrhythmia
EC01		
	EC11	Did not pump above the mean arterial level.
	EC21	Did not pump above systolic pressure.
	EC91	Systole appears higher than the selected maximum cuff pressure limit.
EC02		
	EC12	Did not reach initial cuff pressure. The cuff may have been improperly applied or there may be an air leak.
	EC22	Overpressure.
	EC32	Overpressure.
	EC42	No cuff attached.

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Monitor	Report	Condition
	EC52	Kinked hose.
	EC62	Cuff applied too loosely.
	EC82	Kinked hose.
EC03		
	EC03	Patient canceled reading by pressing STOP key. No retry attempt is made following an EC03 code.
	EC13	The Office Check Mode has been reinstated. No retry attempt is made following an EC13 code.
EC04		
	EC04	Blood pressure measurement not completed in the maximum time allowed. Occasional EC04 messages may result from excessive patient movement. Frequent EC04 messages would indicate an improperly applied cuff or a monitor malfunction which requires service.
	ECn4	(where n = 1 to 9) Indicates that one or more of the blood pressure results have been corrupted and subsequently recovered. Frequent occurrence of this message would indicate a malfunction that requires service.
	EC05	The individual blood pressure result has been corrupted and cannot be recovered.
EC15		Equipment malfunction. Return to Spacelabs Medical for service.
EC25		Unit failed to initialize. Please initialize.
EC35		<p>90207 At least one of the blood pressures or time readings obtained before the event code is erroneous. Interpret all readings with caution.</p> <p>90217 The monitor needs to be reinitialized.</p>
EC05		
EC05 & EC45	EC45	Invalid bleed size. The monitor has automatically changed the bleed size to 8 mmHg.
EC05 & EC55	EC55	An unexpected loss of power possibly caused by: a) removal of the batteries during a blood pressure measurement, b) hardware overpressure, or c) a hardware time-out. Frequent EC55 messages would indicate a malfunction which requires service.
EC05 & EC65	EC65	<p>90207 Equipment malfunction. Return to Spacelabs Medical for service.</p> <p>90217 Extremely large artifact.</p>
EC05 & EC75	EC75	Equipment malfunction. Return to Spacelabs Medical for service.

Monitor	Report	Condition
EC05 & EC85	EC85	Equipment malfunction. Return to Spacelabs Medical for service.
EC05 & EC95	EC95	Cuff pressure baseline out of bounds. The monitor should correct the baseline automatically within 10 minutes, or it can be set by initialization of the monitor. If initialization does not correct the condition, the monitor must be returned to Spacelabs Medical for calibration.
EC07		
	EC78	Clogged connector filter.
EC08		
	EC18	Too few data entries to accurately determine blood pressure. The message may indicate that the cuff is not being worn by the patient (taken off but left connected to the monitor). The message may also indicate that motion artifacts cause the majority of the incomplete data.
	EC28	Diastole above 200 mmHg.
	EC38	Pulse pressure less than 16 mmHg.
	EC48	A) Movement artifact at mean arterial pressure B) Heart rate arrhythmia
	EC58	A) Movement artifact at diastole B) Heart rate arrhythmia
	EC68	Division by zero.
EC09		
	EC19	Contradictory instructions sent to hardware (e.g., "pump on and valve open").
	EC29	Diastolic pressure value cannot be obtained from the data available.
	EC39	90207 Systolic pressure cannot be obtained from the data available. 90217 Algorithm could not process input data quickly enough, resulting in an input queue overflow.
	EC49	90207 Mean arterial pressure cannot be obtained from the data available. 90217 This monitor must be initialized.
	EC59	Heart rate value cannot be obtained from the data available.
	EC69	Heart rate value cannot be obtained from the data available.
	EC79	Bleed steps were too small. This may be caused by a partially obstructed air hose. All blood pressure attempts following this message are inhibited. Attempts can be enabled by turning the power switch OFF then ON.

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Monitor	Report	Condition
	EC99	Unexpected or contradictory data (such as a negative cuff pressure).
LLL		
	EC16	Low battery detected prior to start of measurement.
	EC26	Low battery detected after measurement started. Usually caused by the pump drawing enough current to lower the battery voltage.
Lbb		The report does not print an event code for this condition, which is a low backup battery. Contact Spacelabs Medical for replacement of the battery.

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Checking Accuracy	1
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Checking Accuracy

Accuracy of the monitor pressure readings should be checked annually. Recalibration is necessary only if the unit is not within the accuracy limits.

Required Equipment

- A full-size mercury sphygmomanometer or aneroid gauge.

Note:

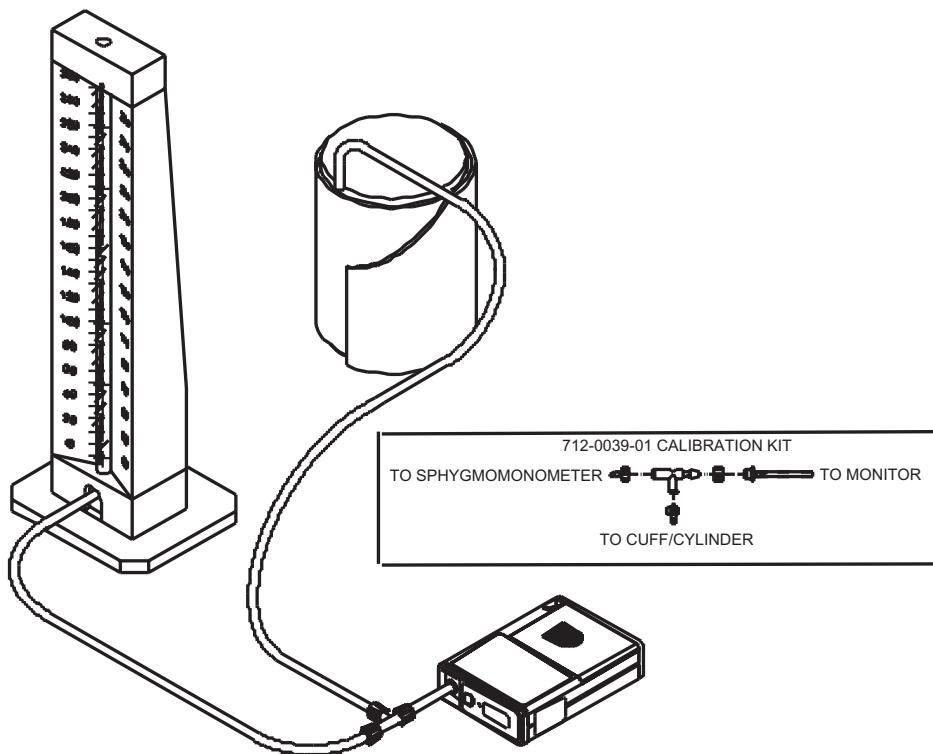
Ensure the mercury sphygmomanometer or aneroid gauge is calibrated and indicates "0" with no pressure.

- T-tube (P/N 016-0040-00).
- A pressure cuff and a rigid cylinder sized to fit the pressure cuff.

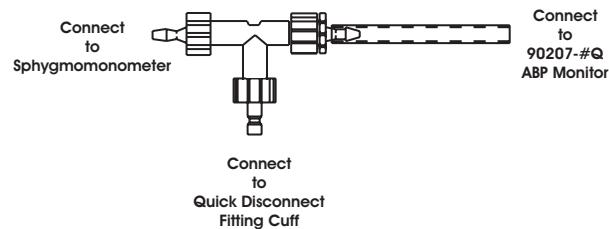
Accuracy Procedure

To check the accuracy of the monitor:

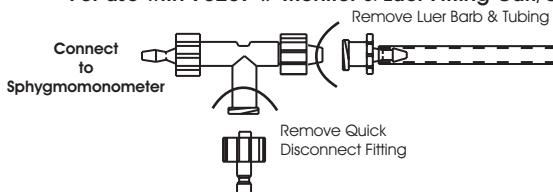
- 1 Disconnect the cuff hose from the monitor. Connect the T-tube splitter to the monitor pneumatic connector and the sphygmomanometer.
- 2 Wrap the pressure cuff around the rigid cylinder, and then fasten the cuff. Connect the cuff hose to the remaining connection on the T-tube splitter. The test setup should appear as shown below.



For use with 90207-#Q Monitor & Quick Disconnect Cuff/Can



For use with 90207-# Monitor & Luer Fitting Cuff/Can



Ambulatory Blood Pressure Monitors

- 3 Press **START/STOP** on the monitor; the monitor should read approximately 165. Compare the readings on the monitor and the manometer as the pressure bleeds down. The monitor reading should be within three millimeters or 2% of the manometer reading, whichever is greater (\pm the accuracy of the manometer).

Note:

If the monitor pressure values fall outside the allowed tolerance, call your local Customer Service Representative or Spacelabs Medical for servicing.

- 4 At the end of the procedure, the monitor displays an event code indicating that no dynamic blood pressure measurements were obtained.
- 5 Disconnect the T-tube splitter from the monitor. Disconnect the air hose and sphygmomanometer.

Troubleshooting

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Problem Solving Checklist

Problem	Possible Cause	Solution
Monitor display is incorrect	Data not retained.	Replace backup battery.
	Low or no power.	Check the batteries for a full charge; if needed, replace or recharge the batteries.
	May be one of the following: time-out, no reading due to air leak in the system, improper cuff size, cuff not properly attached to the monitor.	Isolate cause and correct.
Monitor displays "LLL" and alarm sounds	Low main battery condition.	Power OFF the monitor immediately. Replace batteries within 60 seconds after removal to continue monitoring.
Monitor displays event code Lbb during self-testing (90207 only)	Low backup battery condition.	Replace backup battery before continuing.
Cuff too tight	Cuff placed on the patient too tightly.	Reposition the cuff.
	Air pump staying on too long.	Return unit to Spacelabs Medical for service.
Cuff too loose	Cuff placed on the patient too loosely.	Reposition the cuff.
	Air pump not staying on long enough.	Return unit to Spacelabs Medical for service.
Incorrect time displayed	Batteries removed for more than one minute (90207 only).	Re-initialize monitor.

Servicing

There is a 12-month warranty on this product.

Field service of the ABP monitor is limited to replacing batteries and accessories. If other repair is required, return the monitor to Spacelabs Medical. Contact your Spacelabs Medical Customer Service Representative for shipping details.

Caution

Any attempt to perform service or repair to the monitor will result in cancellation of the warranty.

Symbols

The following list of international and safety symbols describes all symbols used on Spacelabs Medical products. No one product contains every symbol.

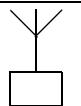
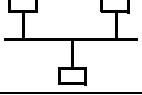
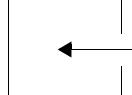
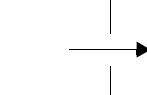
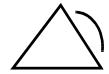
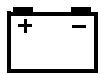
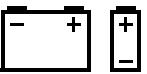
Symbol	Description	Symbol	Description
	HELP Key		Keyboard Connection
	SPECIAL FUNCTIONS Key		Mouse connection
	RECORD Key		START/STOP Key
	NORMAL SCREEN Key		START/STOP
	MONITOR SETUP Key		STOP or CANCEL Key
	ALARMS Key		CONTINUE Key
	PREVIOUS MENU Key		ENTER Key
	ON — Power Connection to Mains		OFF — Power Disconnection from Mains
	ON Position for Push Button Power Switch		OFF Position for Push Button Power Switch
	On Direction		ON/OFF
	Television; Video Display		Video Output
	ON — Part of the Instrument Only		OFF — Part of the Instrument Only

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Symbol	Description	Symbol	Description
	Stand-by		STAND-BY Key
	PAUSE or INTERRUPT		Slow Run
	Reset		Power Indicator LED
	Alarm		Temporary Shut Off of Alarm Tone or Screen Indicators
	Indicator — Remote Control		Indicator — Local Control
	PRINT REPORT Key		Indicator — Out of Paper
	Partial ON/OFF		Recorder Paper
	Normal Screen		Return to Prior Menu
	Clock/Time Setting Key		TREND/TIMER Key
	HELP (Explain Prior Screen) Key		Keypad
	Activate Recorder for Graphics		Indoor Use Only
	START (NIBP) Key		Auto Mode (NIBP)
	Output		No Output (Terminated)

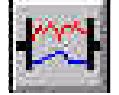
Symbol	Description	Symbol	Description
	Data Input/Output		Input/Output
	Input		Reset
	Menu Keys		Waveform/Parameter Keys
	Monitor Setup Select Program Options		Set Initial Conditions Menu
	Access Special Function Menu		Return Unit to Monitor Mode
	Serial Port 1		Serial Port 2
	External marker push button connection		SDLC Port
	Arterial Pulse		Electrocardiograph or Defibrillator Synchronization
	Gas Exhaust		Foot Switch
	Enlarge, Zoom		Delete
	PCMCIA Card		Event
	Keep Dry		Fragile; handle with care
	Environmental Shipping/Storage Altitude Limitations		This Way Up
	Environmental Shipping/Storage Temperature Limitations		Environmental Shipping/Storage Humidity Limitations

Ambulatory Blood Pressure Monitors

Symbol	Description	Symbol	Description
	Open Padlock		Closed Padlock
	Down Arrow		Up Arrow
	Hard Drive		Power Indicator LED
	Antenna		Mermaid Connector
	Microphone		Omnidirectional Microphone
	Audio Output, Speaker		Activate Telemetry Recorder
	Network Connection		Universal Serial Bus
	Gas Sampling Port		Gas Return Port
	Remote Alarm; Nurse Alert		Nurse Call
	Battery Status		Low Battery
	Battery Replace only with the appropriate battery.		Replace only with the appropriate battery. (+ / - signs may be reversed)
	All batteries should be disposed of properly to protect the environment. Lithium batteries should be fully discharged before disposal. Batteries such as lead-acid (Pb) and nickel-cadmium (Ni-Cd) must be recycled. Please follow your internal procedures and or local (provincial) laws regarding disposal or recycling.		Caution - hazardous voltages. To reduce risk of electric shock, do not remove the cover or back. Refer servicing to a qualified service personnel (U.S.A.). DANGER - High Voltage (International)

Symbol	Description	Symbol	Description
	Protective Earth Ground		Functional Earth Ground
	Replace Fuse Only as Marked		Fuse
	Power supply jack polarity. (+ / - signs may be reversed)		Equipotentiality Terminal
	Alternating Current		Direct Current
	Both Direct and Alternating Current		AC/DC Input
A	Amperes	Hz	Hertz
V	Volts	W	Watts
	IEC 601-1 Type B equipment. The unit displaying this symbol contains an adequate degree of protection against electric shock.		Class II Equipment
	IEC 601-1 Type BF equipment which is defibrillator-proof. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part which contains an adequate degree of protection against electric shock, and is defibrillator-proof.		IEC 601-1 Type BF equipment. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part providing an adequate degree of protection against electric shock.
	IEC 601-1 Type CF equipment. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part providing a high degree of protection against electric shock, and is defibrillator-proof.		IEC 601-1 Type CF equipment. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part providing a high degree of protection against electric shock.
	Loop Filter		Adult NIBP

Ambulatory Blood Pressure Monitors

Symbol	Description	Symbol	Description
	ETL Laboratory Approved		Canadian Standards Association Approved
	Risk of Explosion if Used in the Presence of Flammable Anesthetics		Operates on Non-Harmonized Radio Frequencies in Europe
Note	Note		Attention - Consult Operations or Service Manual for Description
WARNING	Warning About Potential Danger to Human Beings	CAUTION	Caution About Potential Danger to a Device
	Noninvasive Blood Pressure (NIBP), Neonate		Fetal Monitor Connection (Analog)
	Fetal Monitor Connection RS232 (Digital)		Physiological Monitor Connection RS232 (Digital)
	Happy Face		Sad Face
	Magnifying Glass		Compression
	File Cabinet		List of Rooms
	Arrows		Printer
	Recycle		Service Message
	Radio transmitting device; elevated levels of non-ionizing radiation		

Ambulatory Blood Pressure Monitors

Abbreviations used as symbols are shown below.

Symbol	Description	Symbol	Description
1 - 32	Access Codes 1 Through 32	AIR	Air
ANT 1 ANT 2	Diversity Antenna System 1 Diversity Antenna System 2	Arr1 ArrNet2	Arrhythmia Net 1 Arrhythmia Net 2
CH ch	EEG, EMG, or ECG Channel EEG Channels - CH1, CH2, CH3, CH4 EMG Channel - CH5	cmH ₂ O	Centimeters of Water
C.O. CO co	Cardiac Output	DIA dia	Diastolic
ECG ecg	Electrocardiogram	EEG eeg	Electroencephalogram
EMG emg	Electromyogram	ESIS	Electrosurgical Interference Suppression
EXT	External	FECG	Fetal Electrocardiogram
FHR1 FHR2	Fetal Heart Rate, Channel 1 Fetal Heart Rate, Channel 2	GND gnd	Patient Isolated Ground
HLO hlo	High-Level Output	Multiview	Multi-Lead Electrocardiogram
NIBP nibp	Noninvasive Blood Pressure	N ₂ O	Nitrous Oxide
O ₂	Oxygen	PRESS press PRS	Pressure
RESP resp	Respiration	SDLC	Synchronous Data Link Control
SPO ₂ SpO ₂ SpO ₂ SaO ₂	Arterial Oxygen Saturation as Measured by Pulse Oximetry	SVO ₂ SvO ₂ SvO ₂	Mixed Venous Oxygen Saturation

Ambulatory Blood Pressure Monitors

Symbol	Description	Symbol	Description
SYS sys	Systolic	T1 T2 T3 T4	Temperature 1 Temperature 2 Temperature 3 Temperature 4
TEMP temp	Temperature	UA	Uterine Activity or Umbilical Artery
VAC	Vacuum Connection		